Helios

Direct Current Lamps.

The Helios Electric Company

MANUFACTURERS OF ARC LAMPS
FOR EVERY KNOWN SYSTEM OF
INCANDESCENT ELECTRIC
LIGHTING, ALTERNATING OR
DIRECT CURRENT

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Enclosed Arc
Direct Current Lamps.

Guaranteed 150 to 175 hours.

In the early days of electric lighting, when carbons were a source of great expense, inventors turned their attention to some method which would prolong the life of the carbons without detracting from the quality of the light. The Patent records of several countries give ample proof of the complete understanding of the problem before them, which these inventors had at that early period. They failed, but for no reason of theirs. Carbons at that time contained such large quantities of foreign matter that undoubtedly the glass surrounding their arcs was very soon covered with a deposit of foreign matter, obscuring the light, and making the device impractical.

In recent years, however, our carbon factories have been able to make very nearly pure carbons, the per cent. of pure carbon being about 99.95. The impurity is generally silica and hardly noticeable after a run of 100 hours. Once able to obtain pure carbons, the rest was comparatively a small matter.

The inclosed arc, however, has some peculiarities which make it desirable to burn the arc at a relatively large difference of potential. The difference of potential may be decreased by several different methods, such as allowing air to enter the cylinder, but this has the disadvantage of giving a very poor and dirty burning, together with a life of only 25 to 30 hours on a 9.6 ampere circuit. For this reason all attempts to introduce the enclosed arc on series circuits has failed.

The Helios Enclosed Arc Lamp combines the steadiness and reliability of the incandescent lamp, with the higher efficiency of the open arc lamp. The light is mellow, does not hurt the eyes, and is so well distributed as to render the most delicate and commingled shadings of cloth perfectly plain. The color of the light is nearly white, in fact it is the nearest approach to sunlight that is possible.

There are two points which render the enclosed arc light very efficient. The arc burns in an atmosphere of gas very much hotter than in the case with the open air arc, and the carbons used are extremely pure, thus increasing the temperature of the crator.

To arrive at a clear conception of the economy in cost of carbons, let us assume the cost of carbons for open air lamps at $36.00 per thousand, which will make the cost of carbons per lamp per year from $10.00 to $12.00. Upon the same conditions the cost of carbons per lamp per year for the enclosed arc is from 80 cents to $1.00. This represents a saving of $10.00 per lamp per year.

The saving in labor will be in like ratio, but this figure will depend largely upon local conditions. For street lighting in suburban districts, for instance, where the lamps are scattered over a relatively large area, one trimmer with Helios Enclosed Arcs will be able to do the work of ten open arcs.

The feature of this lamp is in the employment of two globes enclosing the arc. By virtue of the construction of the inner globe a complete combustion of the carbon takes place, which does away with one of the greatest dangers of the open air arc lamps. They are absolutely clean and there is no possible fire risk. The inner cylinder or globe acts as the most perfect spark-arrester that could be devised, and has been endorsed as such by all Boards of Fire Underwriters. This construction has the further advantage of rendering the arc entirely noiseless.

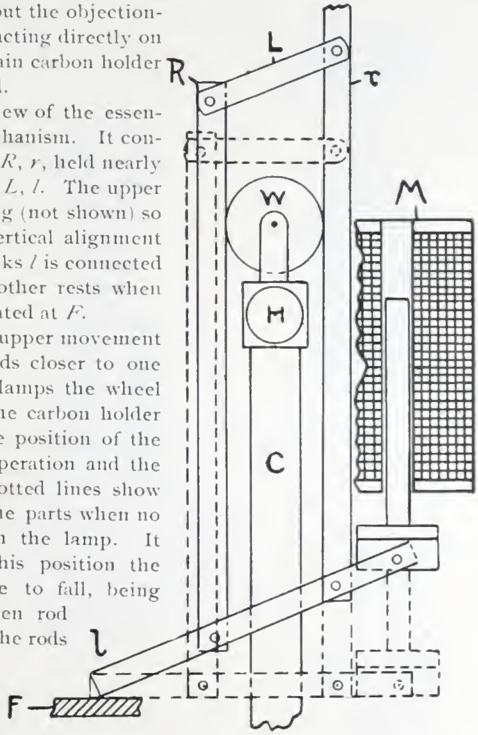
In the open air arc the length of arc, or the distance between carbons when burning, is from $\frac{2}{32}$ to $\frac{3}{32}$ of an inch. In the enclosed arc this is increased to $\frac{3}{8}$ of an inch, making the quantity of light intercepted by the negative much less than in the former case, and the distribution of light is naturally much enhanced.

The wiring necessary for lamps of the enclosed type is very simple. It is only necessary to make your lamp connections as you would for an incandescent lamp, one lamp directly across the mains. They may be turned on or off individually.

The feature of the lamp to which we have given special attention is *ease of trimming*. It is only necessary to unlock the globe from its supports and allow it to swing on the chains to which it is fastened, which gives ready access to the inner cylinder. This type of lamp, with all the good features of an entirely enclosed lamp, is as easy to trim as those older types, in which the outer globe surrounding the cylinder was open at the top. It may be trimmed with perfect ease and safety in the most inaccessible places and has the advantage of being thoroughly dust and weather-proof. The cylinder surrounding the arc is of such dimensions at the top as to readily allow of cleaning and replacing of carbon without the necessity of removing the glass from its holder. This means that the danger of breaking the cylinder is reduced to a minimum. The carbons are firmly held in solid and well-tried carbon holders, in such a manner that the carbons will at all times be in proper alignment, irrespective of any irregularity in them. When the lamp is trimmed with a 12 inch solid positive carbon it will have a guaranteed life of 150 hours, and when so trimmed has a positive cut-out, making it impossible to burn out the negative carbon holder. That portion of the positive which penetrates into the cylinder when the lamp cuts out is sufficient to be used as a negative in the next trimming. This means that *only 12 inches of carbon are necessary for a burning of 150 to 175 hours.*

(1) 110 v.
(2) 220 v.

The lamp-feeding mechanism, as will be seen from the figures, is entirely novel and so simple and strong as to require little or no care beyond occasional cleaning. The lamp is only 30 inches long, and contains no clock-work, ribbon feed or cord-suspension, being in fact, a clutch lamp without the objectionable features of a clutch, acting directly on the carbon, and the uncertain carbon holder necessary with that method.

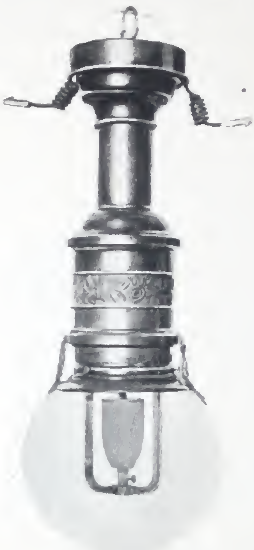


The figure gives a view of the essential parts of the lamp mechanism. It consists of two rods or tubes *R*, *r*, held nearly parallel by two set of links *L*, *l*. The upper end of *r* moves in a bushing (not shown) so as to keep the rods in a vertical alignment at all times. One of the links *l* is connected to the armature while the other rests when feeding on the frame indicated at *F*.

The armature in its upper movement tends to bring the two rods closer to one another, and in this way clamps the wheel *W*, to which is attached the carbon holder *H*. The full lines show the position of the rods when the lamp is in operation and the carbons separated. The dotted lines show the relative positions of the parts when no current is passing through the lamp. It will be noticed that in this position the wheel *W* is perfectly free to fall, being about $\frac{1}{16}$ of an inch between rod and wheel. The action of the rods is similar to that of a parallel rule. When the length of the arc becomes such as to increase the resistance of the arc over the normal, the current passing through the solenoids *M* is decreased and the armature drops.

The link *l* resting on the frame indicated at *F* will tend to spread the rods as the armature descends and the rods will finally come to a position where they no longer grip the wheel, which then falls and feeds the carbon *C*. An over-feed and consequent increase in current is impossible, as the possible travel of the armature is greater than the length of the arc

Enclosed Arcs.

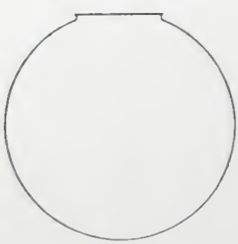


601

611

621

GLOBES.



B^1

These lamps are made for inside and outside purposes, as shown.

Finished in polished, scoured or oxydized brass, or enameled black.

Lamps are rated at nominal 2000 candle power.

Use solid pure carbons only.

Guaranteed 150 to 175 hours life.

The cut shows the style of globe used on this lamp.

Alabaster, $1.00. Ground, 85 cts. Clear, 75 cts.

LAMP SPECIFICATIONS.

Type.	Class.	Amperes.	Volts.	Burning Hours.	Finish.	Price.	Globe.
600	E. D. C.	4¾	76	100	Oxd. Brs.	$40 00	B^1
601	E. D. C.	4¾	76	150	Oxd. Brs.	40 00	B^1
610	E. D. C.	4¾	76	100	Brass.	$40 00	B^1
611	E. D. C.	4¾	76	150	Brass.	40 00	B^1
620	E. D. C.	4¾	76	100	Black.	$30 00	B^1
621	E. D. C.	4¾	76	150	Black.	30 00	B^1
625	E. D. C.	4¾	76	100	Brass.	$35 00	B^1
626	E. D. C.	4¾	76	150	Brass.	35 00	B^1
630	E. D. C.	4¾	76	100	Black.	$40 00	B^1
631	E. D. C.	4¾	76	150	Black.	40 00	B^1

State *Type number* only, and quality of globe, when ordering.

Type 630 and 631, not shown, is intended for continual outside service; the finish is weather-proof.

12x½ inch solid carbon, for use in this lamp, ... $28.00 M.

Enclosed Arc Instructions.

The lamps, before leaving the factory are adjusted for 110 volt circuits, when not otherwise specified.

Should the E. M. F. on the circuit where it is desired to burn the lamp be higher or lower than the factory adjustment, the lamp may be readily adjusted to the existing conditions as follows:—Remove the screws which hold the trimming covering the resistance, allowing the trimming to drop, exposing the resistance as shown in the illustration. To cut in or cut out resistance insert a bare copper wire between the section of resistance intended to be cut out and the bare copper wire running around the bottom of the insulators. After twisting the small wire into position be careful to cut off the end so as not to short circuit the lamp on the trimmings.

The lamps are intended to burn at about 76 volts and 4¾ amperes, and have sufficient resistance for a 120 volt circuit.

The lamps are burned singly across direct current constant potential circuits. The carbon which is used for this lamp is a solid half-inch carbon of special make. It is absolutely necessary to use these, as other carbons *will not* burn in the lamp.

To trim the lamp it is first necessary to see that the cylinder is cleaned thoroughly. For this purpose and for

trimming it is taken out of the lamp, and when trimmed, returned. For the purpose of cleaning, a dry brush, such as is commonly used in cleaning globes, will be found convenient.

It is not necessary to take the cylinder from its holder for any other purpose than that of replacing a broken cylinder, and then sufficient care must be exercised to secure an air tight joint at the bottom. The carbon which is placed into the cylinder should be 4⅛ in. long, and should be well centered so as to secure an even burning of the carbons. After the cylinder is cleaned and a carbon is put in, the cap is put on and it is ready for the lamp.

The lamp is trimmed in the following manner : Insert the positive carbon by pushing it through the hole in the bottom of the frame and through the hole in the guide plate. Be careful to fasten the carbon tightly in the holder, as the lamp will be short-circuited should the carbon drop out. Next push the positive carbon up into the lamp so that the bottom of the carbon rests on the guide plate ; then insert the cylinder (with the cap on) by lifting the guide plate allowing the cylinder holder to drop into the hole in the bottom frame. Lower the guide plate and allow the positive carbon to drop through it and into the cylinder. Adjust the outer globe and the lamp is ready to burn.

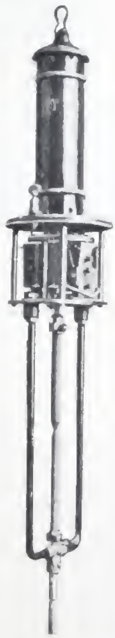
When the lamp is first hung the guide plate should be so adjusted as to just clear the top of the cap without resting on it. This is done by raising or lowering the nuts, holding the guide frame.

The carbon which is left over from the positive after burning will be found sufficient to serve as a negative in the next trimming.

A lamp which is burning for the first time will generally be slightly unsteady for a short time. This is due to moisture which has accumulated in the globe and lamp. *It may be said in general that moisture in the cylinder should always be avoided, and the carbons should be thoroughly dry when put into the lamp.*

Open Arc
Direct Current Lamps.

The Helios Rack, open shunt feed, direct current arc lamp has been thoroughly tried commercially with most gratifying success.



It is novel in design, being most radical in its conception, the feeding device is entirely different in principle than anything ever offered in the form of an arc lamp for constant potential direct current lighting.

The feed of one lamp does not interfere with that of any of the others in series with it, we can therefore guarantee that

With two lamps in series on 110 volts, they will not see-saw.

Lamps will burn with accuracy 4 on 220 volts.

There is nothing cheap about the lamp, the mechanical construction and workmanship is of our usual high standard.

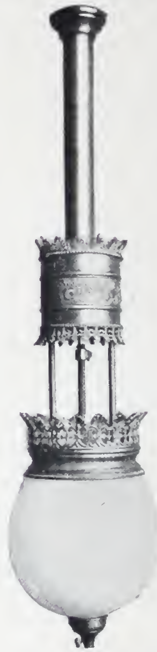
With these lamps we recommend the use of a soft cored carbon above for the positive and a solid lower for the negative, with this arrangement they will burn more economical than solid carbons top and bottom, and absolutely steady and quiet.

Standard lamps are made 4, 6½, 8 or 10 amperes, and we guarantee them to burn at their rated capacity.

Open Arc
Direct Current Lamps.

303

317



353

325

D²

Standard Globe D¹ for seven hour frame, D² for fourteen hour frame, used on all the above Types of lamps.

Alabaster, 60 cts. Ground, 50 cts. Clear, 40 cts.

Lamps have self-contained resistance, except 303. Mention *Type number* only, and quality of globe, when ordering.

Discounts on application, except on globes.

LAMP SPECIFICATIONS.

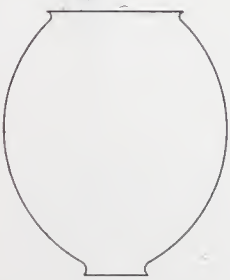
Type.	Type.	Type.	Type.	Class.	Amperes.	Candle Power.	Burning Hours.	Style Globe.	Carbons, mm.	
									Cored.	Solid.
300	310	320	350	D. C.	4	900	7	D¹	12x160	8x160
301	311	321	351	D. C.	4	900	14	D²	12x240	8x240
302	312	322	352	D. C.	6½	1200	7	D¹	15x160	10x160
303	313	323	353	D. C.	6½	1200	14	D²	14x305	14x180
304	314	324	354	D. C.	8	1800	7	D¹	15x160	10x160
305	315	325	355	D. C.	8	1800	14	D²	14x305	14x180
306	316	326	356	D. C.	10	2000	7	D¹	18x160	12x160
307	317	327	357	D. C.	10	2000	14	D²	16x305	16x180
Black $27 00	Black $27 00	Black $30 00	Brass $40 00	Price, including resistance, but no globe.						

Open Arc Direct Current Lamps.

333

345

365



S^1

S^1 The style globe shown is used on the above Types of lamps.

Alabaster, $1.00. Ground, 85 cts. Clear, 75 cts.

All lamps have self-contained resistance. Type 365 will be furnished with separate resistance if desired. Give *Type number* only, and quality of globe when ordering.

Discounts on application, except on globes.

LAMP SPECIFICATIONS.

Type.	Type.	Type.	Class.	Amperes.	Candle Power.	Burning Hours.	Style Globe.	Carbons, mm. Cored.	Carbons, mm. Solid.
330	340	360	D. C.	4	900	7	S^1	12x160	8x160
331	341	361	D. C.	4	900	14	S^1	12x240	8x240
332	342	362	D. C.	6½	1200	7	S^1	15x160	10x160
333	343	363	D. C.	6½	1200	14	S^1	14x305	14x180
334	344	364	D. C.	8	1800	7	S^1	15x160	10x160
335	345	365	D. C.	8	1800	14	S^1	14x305	14x180
336	346	366	D. C.	10	2000	7	S^1	18x160	12x160
337	347	367	D. C.	10	2000	14	S^1	16x305	16x180
Black $35 00	Brass $40 00	Brass $46 50	Price, complete, except globe.						

Open Arc Direct Current Lamps.

375

381

405

H²

The style of Globe shown is used on the above Types of lamps.

Alabaster, 90 cts. Ground, 60 cts. Clear, 50 cts.

All lamps have self-contained resistance. Type 375 will be furnished with separate resistance if desired. Give *Type number* only, and quality of globe, when ordering.

Discounts on application, except on globes.

LAMP SPECIFICATIONS.

Type.	Type.	Type.	Class.	Amperes.	Candle Power.	Burning Hours.	Style Globe.	Carbons, mm.	
								Cored.	Solid.
400	380	370	D. C.	4	900	7	H¹	12x160	8x160
401	381	371	D. C.	4	900	14	H²	12x240	8x240
402	382	372	D. C.	6½	1200	7	H¹	15x160	10x160
403	383	373	D. C.	6½	1200	14	H²	14x305	14x180
404	384	374	D. C.	8	1800	7	H¹	15x160	10x160
405	385	375	D. C.	8	1800	14	H²	14x305	14x180
406	386	376	D. C.	10	2000	7	H¹	18x160	12x160
407	387	377	D. C.	10	2000	14	H²	16x305	16x180
Black $37 00	Brass $35 00	Brass $50 00	Price, complete, except globe.						

INSTRUCTIONS.

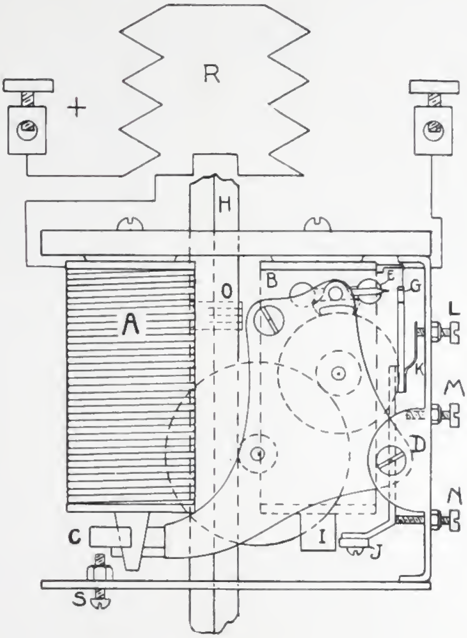
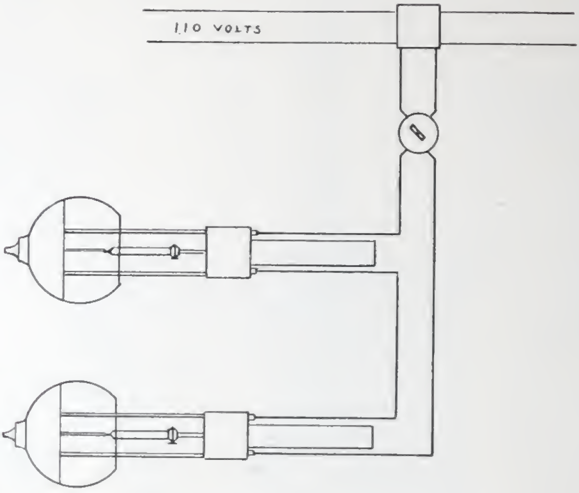


Fig. 1.

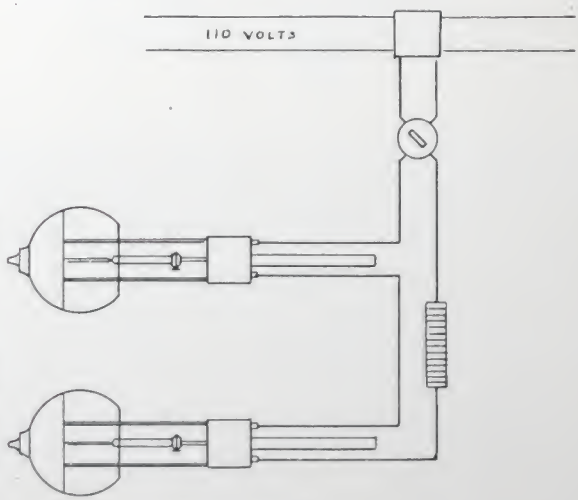
The mechanism of this lamp is shown in Fig. 1. It is composed of the series coils *A*, the shunt coils *B* and the clock-work escapement gearing into the rack rod *H*. When the lamp is first turned on, the carbons being together, the current flows through the series coils *A* magnetizing the cores and attracting the armature *C*. This lifts the clock-work mechanism, which is pivoted at *D* and separates the carbons, thus starting the arc. The lifting of the mechanism causes the escapement *E* to engage the point *G* and prevents the rod from running down again immediately. The only office of the series coils is to start the arc, and the armature *C* should be held up tightly while the lamp is burning.

The feeding is done by the shunt coils *B*. It depends upon the voltage across the arc and is entirely independent of the amount of current passing through the lamp. When the voltage on the arc gets high enough to cause sufficient flow of current through the shunt coils, their magnetism attracts the armature *J*; this releases the escapement at *G* and allows the lamp to feed. But whenever the escapement is released, the current through the shunt coils is opened on the platinum point *G*, shunting the current through a high resistance mounted on the shunt spool, and thus preventing any sparking or wear at the point *G*. When this is done the armature *J* immediately flies back to its former position and the lamp has fed just one tooth on the escapement wheel or $\frac{1}{200}$ of an inch on the carbon rod.

The tension on the spring *K* varies the pull necessary to attract the armature *J* and consequently varies the voltage at which the lamp will feed. The screws *M* and *N* regulate the back and forward movement of the armature *J*; and *S* the striking distance of the arc.



Method of connecting self-contained resistance lamps.



Method of connecting separate resistance lamps.

Fig. 2

The current flows from the + binding post through the chimney resistance *R'* to the series coils and by means of the brush *O* to the carbon rod *H*, thence through the arc and back through the side rod to the — binding post. The mechanism is alive in the positive direction. From the mechanism a current flows through the shunt coils and through the platinum contacts at *G* to the — terminal.

ADJUSTMENT.

If the lamps do not feed properly, adjust them carefully as follows: set the bottom screw *N* so that when the armature *C* is down the escapement will just clear the point *G*; when it is right the carbon rod should run down slowly when released and the mechanism work freely, but should immediately lock when the armature *C* is raised. Next set the middle screw *M* so that the armature *J* can not touch the pole piece *I* by about $\frac{1}{32}$ of an inch when at its extreme position. If allowed to swing against the pole piece it is liable to stick and allow the carbons to feed clear together. The top screw *L* regulates the voltage at which the lamp will feed. Connect a volt-meter across the arc and vary the tension on the spring *K* by means of the screw *L* until it feeds at 45 volts.

Adjust the resistance in series with the lamp so that it takes its rated current. With two lamps in series all the resistance should be in at 120 volts and all out at 95 volts. For intermediate pressure adjust the resistance by means of the sliding contacts. The lamp requires a slight excess of current to start the arc promptly, but as the carbons burn off the current falls to the normal. Measure the current after the lamp has begun to feed.

CONNECTIONS.

The method of connecting these lamps to incandescent circuits is shown in Fig. 2. Each lamp requires 45 volts and they may be connected in series across a constant potential circuit of any voltage. With 110 volts it is necessary to have a resistance in series to absorb the voltage between the 90 consumed by two lamps and 110. With 220 volts four are placed in series with resistance and for 500 volts 10 can be used. It is usually better to have resistance in series with the lamps to take care of any variation in pressure. The resistance can be self-contained on the tower of the lamp or separate as desired.

CARBONS.

To get a steady light a soft-cored carbon should be used above and a smaller diameter solid carbon below. These should be the same length so as to burn at the same rate and not burn out the carbon holders. Hard solid carbons cause flickering, hissing, etc., due to the impurities contained in them. Good quality of carbons more than pay for themselves in the satisfaction they give to customers.

SPECIAL INSTRUCTIONS.

If the lamp consumes to much current cut in more resistance at R.

If the lamp consumes less than its rated current cut out resistance at R.

If the light dies down just before feeding cut out resistance.

If the carbons feed clear together adjust the middle screw, M.

Clean the carbon rod at each trimming.

Where the voltage is variable adjust the lamps for the lowest pressure.

If the lamps jump at starting, adjust screw S, also cut out little of the resistance at R.

Railway Arc Lamps.

The demand for Arc Lamps to operate in conjunction with electric railway service has never been an absolute success on account of the unavoidable variations of the power circuits, and also the type of lamp offered for this exacting duty has not been of the proper design.

A lamp for this work should be absolutely positive in its action, and capable of withstanding considerable electrical abuse.

On 500 volts from a constant potential machine, compound wound, it is safe to operate ten lamps in series; where the demand of the line otherwise does not cause a drop of over 10 per cent., a greater variation than this will cause one of the lamps in the series to drop out, and in such cases it is advisable to use but nine lamps in series.

The principle of our lamp is the only proper conception of regulation for work of this character.

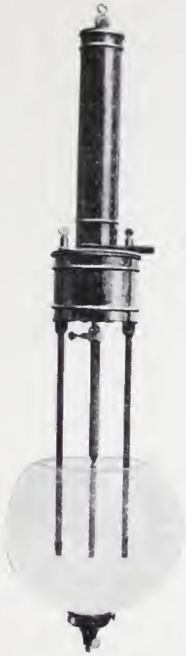
They are built for either eight or ten amperes.

With each set of lamps we furnish an adjustable resistance with a capacity for nine lamps in series on 500 volts or ten lamps to a series on 525 volts.

The construction of the lamp is on the same principle as our regular constant potential lamp, but is provided with an automatic cut-out, which cuts in or out the arc where the variations are sufficient to cause such action, and by this means the series is never interrupted.

There is also an external switch to each lamp to be used for trimming while lamps are in service.

The positive strike of the arc, the method of feeding, the automatic devices, combined with the switch makes this a most desirable lamp for railway circuits; and to those who are contemplating adding this method of lighting to their circuits, we heartily recommend this lamp and will guarantee satisfactory results where the variations are not greater than 10 per cent.

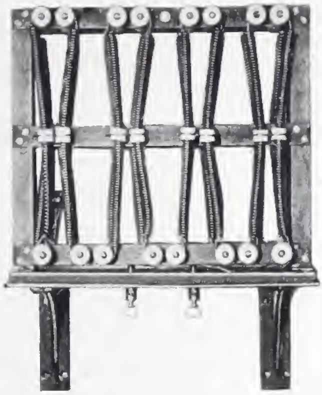


391

Railroad Lamps.

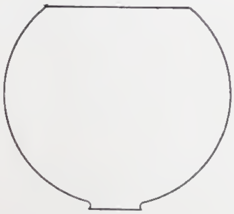
Railway Lamps are finished in enamel black only.

Type 391 for inside use.
Type 398 for outside use.



Resistance No. 7.

398



D²

A standard globe is used on this lamp with 2¼ inch bottom fitting and 8 inch top opening. Style D¹ for seven hour frame. Style D² for fourteen hour frame.

Alabaster, 60 cts. Ground, 50 cts. Clear, 40 cts.

Prices include the extra resistance, but no globes. State the *Type* only when ordering, and quality of globe.

Discounts on application, except on globes.

LAMP SPECIFICATIONS.

Type.	Class.	Amperes.	Candle Power.	Burning Hours.	Finish.	Price.	Style Globe.	Carbons, mm.	
								Cored.	Solid.
390	R. D. C.	8	1500	7	Black	$42 50	D¹	15x160	10x160
391	R. D. C.	8	1500	14	Black	42 50	D²	14x305	14x180
392	R. D. C.	10	2000	7	Black	42 50	D¹	18x160	12x160
393	R. D. C.	10	2000	14	Black	42 50	D²	16x305	16x180
395	R. D. C.	8	1500	7	Black	$45 00	D¹	15x160	10x160
396	R. D. C.	8	1500	14	Black	45 00	D²	14x305	14x180
397	R. D. C.	10	2000	7	Black	45 00	D¹	18x160	12x160
398	R. D. C.	10	2000	14	Black	45 00	D²	16x305	16x180

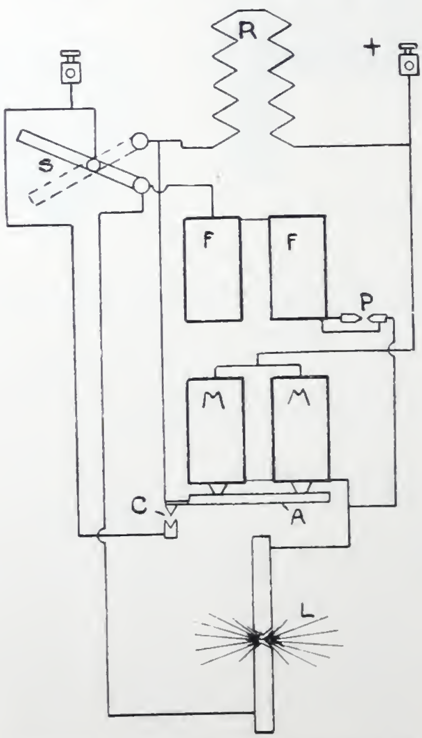
Instructions.

Our railway lamps are adjusted for a current of 8 or 10 amperes with 46 volts at the arc when used with a cored carbon upper and a solid lower.

Nine lamps are used in series where the maximum voltage is lower than 450, and ten lamps to a series where the average is above 500 volts.

The excess voltage is taken up by the extra resistance furnished with each series of lamps, and is adjusted by the clip attachment to the requirements of the line operating each series of lamps.

By placing a voltmeter across the junction point supplying each series, the voltage at this point, less the sum of voltage for the total number of lamps in series, allowing 46 volts to each lamp, will be the amount of excess voltage to be taken care of by the external resistance, at the same time care should be taken not to allow the current flow as indicated by an ammeter in the circuit, to run high or low, as the resistance governs this feature.



The lamps when started will naturally take an excess of current and ampere readings should not be adjusted until the lamps have fed once or twice which allows the circuit to settle down to regular burning.

The positive or + side of lamp should be connected to the + side of the line, the negative or — side of the lamp to the + side of next lamp and so on throughout the series returning the negative through a double pole switch, back to negative of feeder circuit.

The fuse protection should be placed at the junction point, the resistance can be placed on either the positive or negative line, but must be inside of switch and fuse.

If any lamp has been injured, or from any cause fails to burn, connect it up on some low potential circuit, and adjust it to feed at 46 volts while passing the rated current; for this purpose refer to the instructions for our regular constant potential lamp, which also apply to this lamp.

Before placing the lamps in their final position it is advisable to run them in a bunch on the circuit for which they are intended; upon closing the switch all lamps in the circuit should pick up instantly, and within a short time feed. See that the current is passing in right direction, by noting the direction of light, if in an upward direction the connection should be reversed to form the crater of the arc on the upper carbon.

After the lamps are burning properly the arcs should all be of equal length from $\frac{1}{16}$ of an inch to $\frac{1}{8}$ inch.

If the ammeter reads too high cut in more of the external resistance.

If the circuit should have an excess drop, cut out one lamp, or if there is too much resistance cut it out also.

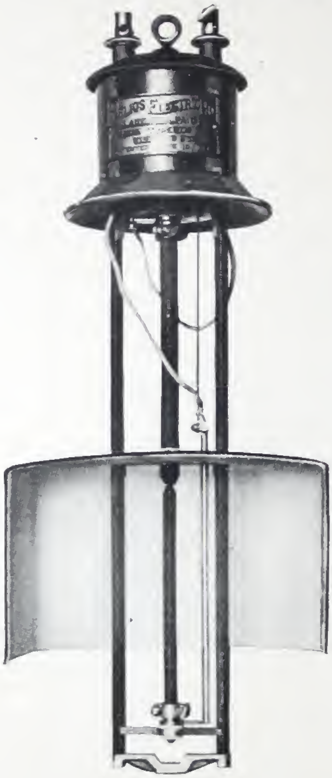
By referring to the figure the circuits of our railway lamp may be readily understood, *M. M.*, are the series arc striking coils; *F. F.*, are the shunt feeding coils; *R*, is the resistance for automatic cut-out; *S*, the lamp switch, *A*, the rack lifting armature; *C*, the contact points for automatic cut-out, and *L*, the arc.

With the switch in position shown, the current will pass through *M. M.*, to the arc *L*, and out the negative of the lamp; this is the normal position when lamp is in service; should the voltage drop sufficient to allow the armature *A* to drop, the current then passes from *R* to *C* and out through the negative of lamp; this is also the case when the carbons burn out.

When the switch is in the position of the dotted lines, the current passes directly from positive of lamp through *R* and out at the negative, which relieves the mechanism of all current.

The shunt feeding coils *F. F.* are a distinct circuit in each lamp and are in service only when the lamp is burning through the points *P*. This feature is one of great merit and should be studied, as it is the only lamp by which the shunt coils are out of service when lamp is automatically cut out, and is the saving of heavy repairs.

Photo-Engraving Lamps.



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ALTERNATING OR DIRECT CURRENT.

The conditions necessary to obtain good results for this class of work are very exacting. A lamp of high candle power, and of convenient size to handle, at the same time an extremely steady light, are necessary adjuncts to the success of the Photo-Engraver.

A large number of our lamps are in use throughout the country, in this city alone there is in daily use 250,000 candle power of direct and alternating current lamps, among the daily papers and prominent Photo-Engravers.

The distinct advantages of our Photo-Engraving Lamps are :—

Its absolute steadiness. There is no variation or fluctuation of the light, so that the time for exposure can be positively relied upon.

The concentration of the light. All the rays emitted are projected in the one direction giving the required intensity with a comparatively small arc.

The peculiar composition or color of the light is for most purposes superior to sunlight.

Class P. A. C. is alternating current Photo Lamp.

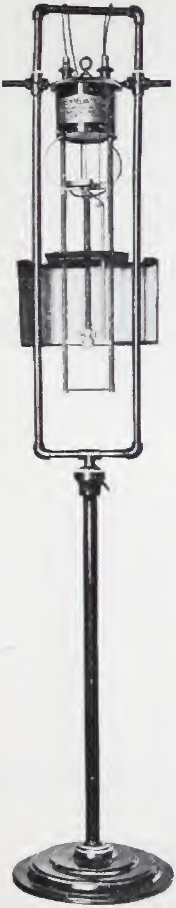
Class P. D. C. is direct current Photo Lamp.

Complete with reflector.

Discounts on application.

LAMP SPECIFICATIONS.

Type.	Class.	Amperes.	Volts.	Candle Power.	Burning Hours.	Price.	Carbons, mm.	
750	P. A. C.	20	35	2500	8	$50 00	20x240	
751	P. A. C.	25	35	3000	8	60 00		
752	P. A. C.	30	35	3500	8	70 00		
753	P. A. C.	35	35	4000	8	80 00		
							Cored Upper.	Cored Lower.
730	P. D. C.	15	48	2500	8	$40 00	18x240	13x240
731	P. D. C.	18	48	3000	8	50 00		
732	P. D. C.	20	48	3500	8	60 00		
733	P. D. C.	23	48	4000	8	70 00		



750 Lamp.
No. 4, Stand.

Photo-Engraving Lamps.

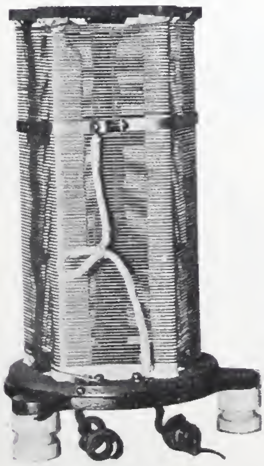
The usual practice for installing lamps is to suspend the lamp on cord, rigged with pulleys and counter balance, but in some cases a telescopic stand is more preferable, as shown.

No. 4 stand, ... $8.00

Lamps are best regulated by running single, on 50 volt alternating, or 110 volt direct current, the resistance as shown below, which is adjustable, is required with each lamp.

RESISTANCE.

One No. 6, is required with each lamp on 50 volts alternating current; One No. 6, is required with each lamp on 100 volts alternating current; One No. 6, for each lamp on 110 volt direct current.

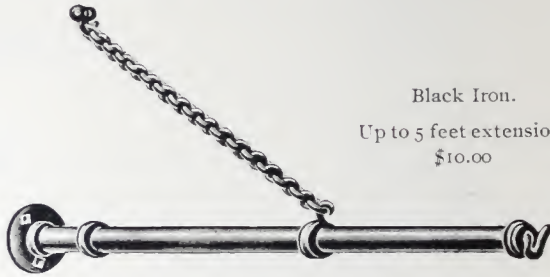


No. 6.

No. 6, ... $8.00.

When ordering lamp always give the voltage on which the lamp is to be operated, as well as the type number, and whether alternating or direct current is to be used.

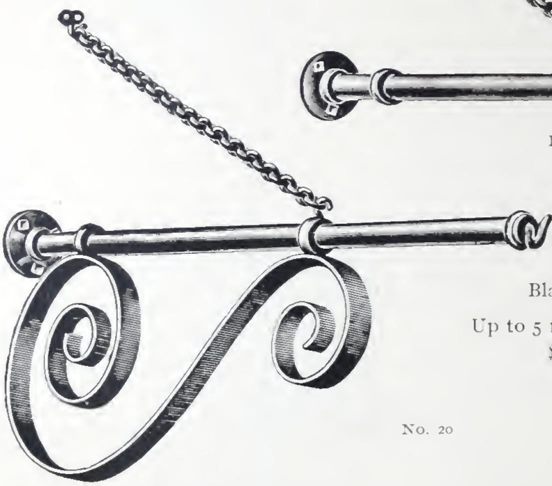
Bracket Out Riggers.



Black Iron.

Up to 5 feet extension,
$10.00

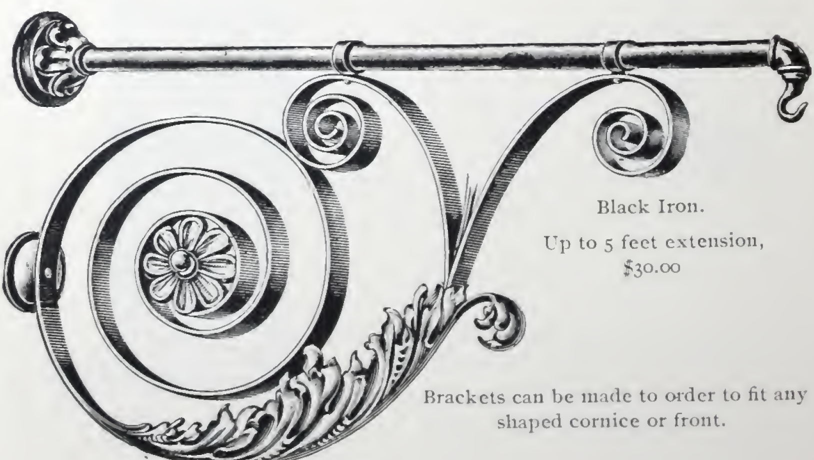
No. 10.



Black Iron.

Up to 5 feet extension
$18.00

No. 20



Black Iron.

Up to 5 feet extension,
$30.00

Brackets can be made to order to fit any shaped cornice or front.

No. 30

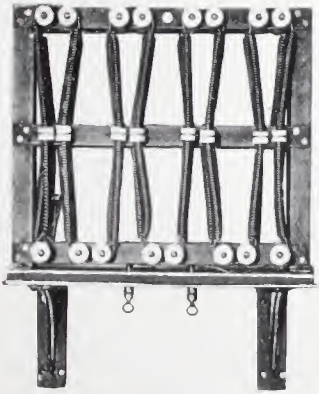
Resistances.

No. 2.

No. 5, wound with 800 inches of No. 15 German Silver Wire $4.50.

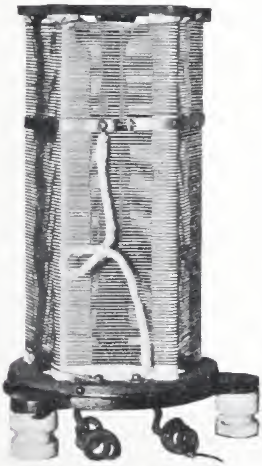
No. 4, wound with 700 inches of No. 14 German Silver Wire $4.25.

No. 2, wound with 650 inches of No. 12 German Silver Wire $4.00.



No. 7.

Wound with 2550 inches No. 12 German Silver Wire, $12.00.



No. 6.

Wound with 2000 inches No. 14 German Silver Wire, $8.00.

No. 9.

Hanger Cross-Arm

No. 9, $3.00

Carbons.

Alternating Cored,—Upper and Lower.

Millimeters.		Inches.		Price Per Thousand
Diameter.	Length.	Diameter.	Length.	
12	160	$\frac{15}{32}$	$6\frac{5}{16}$	$14 00
12	240	$\frac{15}{32}$	$9\frac{1}{2}$	20 00
13	160	$\frac{1}{2}$	$6\frac{5}{16}$	15 00
13	240	$\frac{1}{2}$	$9\frac{1}{2}$	22 00
14	160	$\frac{9}{16}$	$6\frac{5}{16}$	20 00
14	240	$\frac{9}{16}$	$9\frac{1}{2}$	25 50
15	160	$\frac{19}{32}$	$6\frac{5}{16}$	19 00
15	240	$\frac{19}{32}$	$9\frac{1}{2}$	28 00
16	160	$\frac{5}{8}$	$6\frac{5}{16}$	23 00
16	240	$\frac{5}{8}$	$9\frac{1}{2}$	31 00
20	160	$\frac{25}{32}$	$6\frac{5}{16}$	30 00
20	240	$\frac{25}{32}$	$9\frac{1}{2}$	45 00

Direct Current.

Cored Upper, Solid Lower.

Millimeters.				Inches.				Price Per Thousand	
Cored.		Solid.		Cored.		Solid.			
Diam.	Length.	Diam.	Length.	Diam.	Length.	Diam.	Length.	Cored	Solid
12	160	8	160	$\frac{15}{32}$	$6\frac{5}{16}$	$\frac{5}{16}$	$6\frac{5}{16}$	$14 00	$ 7 00
12	240	8	240	$\frac{15}{32}$	$9\frac{1}{2}$	$\frac{5}{16}$	$9\frac{1}{2}$	19 00	10 40
13	240	10	240	$\frac{1}{2}$	$9\frac{1}{2}$	$\frac{3}{8}$	$9\frac{1}{2}$	21 00	13 90
15	160	10	160	$\frac{19}{32}$	$6\frac{5}{16}$	$\frac{3}{8}$	$6\frac{5}{16}$	18 50	9 25
15	240	10	240	$\frac{19}{32}$	$6\frac{5}{16}$	$\frac{3}{8}$	$9\frac{1}{2}$	27 00	13 90
14	305	14	180	$\frac{9}{16}$	12	$\frac{9}{16}$	7	28 65	15 65
18	160	12	160	$\frac{23}{32}$	$6\frac{5}{16}$	$\frac{15}{32}$	$6\frac{5}{16}$	26 00	11 75
18	240	12	240	$\frac{23}{32}$	$9\frac{1}{2}$	$\frac{15}{32}$	$9\frac{1}{2}$	39 00	17 60
16	305	16	180	$\frac{5}{8}$	12	$\frac{5}{8}$	7	38 60	20 85
20	160	16	160	$\frac{25}{32}$	$6\frac{5}{16}$	$\frac{5}{8}$	$6\frac{5}{16}$	28 00	17 50
20	240	16	240	$\frac{25}{32}$	$9\frac{1}{2}$	$\frac{5}{8}$	$9\frac{1}{2}$	47 00	27 75

[illegible]